ZooKeys 14: 55-65 (2009)
doi: 10.3897/zookeys.14.193
www.pensoftonline.net/zookeys

RESEARCH ARTICLE

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Two new species of *Xanthopimpla* (Hymenoptera, Ichneumonidae) from Western Amazonia, with a revised key to the Neotropical species of the genus

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Academic editor: *Michael Sharkey* | Received 8 May 2009 | Accepted 9 July 2009 | Published 10 July 2009

urn:lsid:zoobank.org:pub:0B3C6DA3-9D2B-48C2-AEE0-5C86D73ABFBC

Citation: Gómez IC, Sääksjärvi IE, Veijalainen A, Broad GR (2009) Two new species of *Xanthopimpla* (Hymenoptera, Ichneumonidae) from Western Amazonia, with a revised key to the Neotropical species of the genus. ZooKeys 14: 55-65. doi: 10.3897/zookeys.14.193

Abstract

Xanthopimpla Saussure, 1892 is one of the largest genera of the family Ichneumonidae. The genus is very species rich in Indo-Australia but poorly represented in the Neotropical region. In this paper two morphologically very distinctive species of the genus, *X. amazonica* **sp. n**. Gómez, Sääksjärvi & Veijalainen, and *X. jussilai* **sp. n.** Veijalainen, Sääksjärvi & Broad, are described and illustrated. The new species have been collected in the Peruvian and Ecuadorean Amazonia. A revised key to the Neotropical species of the genus is provided. *Xanthopimpla aurita* Krieger is recorded for the first time from Peru.

Keywords

Taxonomy, Hymenoptera, Ichneumonidae, Pimplinae, *Xanthopimpla*, New species, Amazonia

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Introduction

After the revisionary works of Gauld (1991) and Gauld et al. (1998), the subfamily Pimplinae has become taxonomically one of the best-known ichneumonid taxa in the Neotropical region. Many Neotropical pimplines seem to occur over vast geographic areas (Gaston and Gauld 1993), which makes these works also helpful for identifying South American species. It is, however, important to take into account that the diverse Ichneumonidae fauna of South America still remains very poorly known (Gupta and Gupta 1984), and only a couple of South American study localities have been adequately sampled. Especially the ichneumonids occurring in the vast Amazonian lowland rain forest area are inadequately studied. During the last decade only the Western Amazonian ichneumonid fauna has been sampled in more detail (e.g. Sääksjärvi et al. 2003, 2004). These studies have revealed a high species richness of Ichneumonidae and a plethora of new taxa in areas that were considered rather species poor by earlier workers. According to our unpublished data, it seems to us that many South American pimplines are actually more restricted in their distribution than was previously thought.

Many studies concerning Amazonian ichneumonids have concentrated on the subfamily Pimplinae for several reasons. First, it is biologically one of the most diverse ichneumonid subfamilies (Fitton et al. 1988, Gauld 1991) and may be easily divided into several ecological groups (Gauld 1991, Sääksjärvi et al. 2004, 2006). In addition, many pimpline species are relatively easy to collect by long term Malaise trapping or canopy fogging (Gaston and Gauld 1993, Gauld et al. 1998, Sääksjärvi 2003, Sääksjärvi et al. 2003, 2004) and their phylogeny has been well studied at both super- and suprageneric levels (Wahl and Gauld 1998, Gauld et al. 2002, Sääksjärvi et al. 2004, Gauld and Dubois 2006, Palacio et al. 2007).

Xanthopimpla Saussure is one of the most species rich genera of Ichneumonidae. The species of the genus are idiobiont endoparasitoids of the pupae of Lepidoptera (Townes and Chiu 1970, Gauld 1991). Many *Xanthopimpla* species are very abundant in tropical areas and it is common to see them flying among the vegetation. They are easy to recognize in the field as they are lemon yellow in coloration and have very stout bodies. A closer look reveals the triangular vertical crests on the mesoscutum across the front end of the notaulus, clypeus divided by a transverse suture into basal and apical parts, and twisted mandibles with only the upper teeth visible.

Townes and Chiu (1970) revised the Indo-Australian species of the genus and divided it into about 20 distinctive species-groups. The Ethiopian and Madagascan species were treated earlier by Krieger (1914) and Seyrig (1932). Townes (1969) revised the few known Neotropical species of *Xanthopimpla* and described one new species. According to Townes all Neotropical species belong to the single, endemic a*urita* species-group. However, *X. amazonica* sp. n. and *X. jussilai* sp. n. differ substantially from other species of the *aurita* species-group and we hypothesize that they may actually belong to a new species group endemic to western Amazonia. This hypothesis will be tested further when the Neotropical fauna is better sampled. Thus, one or more monophyletic units may emerge in addition to the *aurita* species-group.

The *aurita* species-group sensu Townes is represented in Central and South America by five known species (Townes 1969, Gauld 1991, Gauld et al. 1998) and a few undescribed species (see e.g. Sääksjärvi 2003). *Xanthopimpla* is very species poor in the Neotropical area in comparison with the Old World tropics, which harbour about 300 species, with many species occurring sympatrically (Townes 1969, Townes and Chiu 1970).

In its distribution *Xanthopimpla* resembles another pimpline genus, *Nomosphecia* Gupta, which is also predominantly Indo-Australian with only six described species occurring in Central America and Brazil and three undescribed species in Peruvian Amazonia (Gauld 1991, Graf 1997, Gauld et al. 1998, Sääksjärvi 2003). However, *Nomosphecia* is a far less diverse genus in comparison with *Xanthopimpla*.

In western Amazonia, the genus *Xanthopimpla* is currently represented by five described species: *X. amazonica* sp. n. recorded in Peru, *X. aurita* ranging from Mexico south to Peru, *X. craspedoptera* ranging from Costa Rica south to Peru, *X. jussilai* sp. n. recorded in Ecuador, and *X. peruana* recorded in Ecuador and Peru (Townes 1969). The predominant species is *X. aurita* Krieger which is, besides e.g. *Pimpla croceiventris* (Cresson) and many undescribed species of *Neotheronia* Krieger, one of the most abundant pimpline species in our Peruvian Amazonian Malaise trap samples collected from the Departments of Loreto and Madre de Dios. *Xanthopimpla craspedoptera* Krieger is also present in samples collected from the Department of Loreto but it is much less common than *X. aurita*. We have also collected two apparently new species resembling *X. aurita*, but as they are represented by very few specimens we decided to refrain from describing these species in the present paper. We hope to find more specimens of these species to better confirm the relatively minor morphological differences. The western Amazonian *Xanthopimpla* occur sympatrically with, for example, the very diverse genus *Neotheronia*, and many species of these genera seem to belong to the same mimicry complexes.

The main aim of the present study is to describe two new and morphologically extremely distinctive species of *Xathopimpla* from the Peruvian and Ecuadorean Amazonia. Both of the species possess an extremely strong occipital carina which is produced into an almost vertical lamella. The authors of the present paper have not seen anything so extreme in other ichneumonid taxa. Both of these new western Amazonian *Xanthopimpla* species occur in an area with the highest known diversity of butterflies in the world (e.g. Robbins and Opler 1997).

Material and methods

The female holotype of *Xanthopimpla amazonica* sp. n. was collected by the first author in lowland rain forest at the Los Amigos conservation station (12°34'07" S, 70°05'57" W) at around 240 m elevation in the Department of Madre de Dios, Peru, between the 17th and 21st of August, 2008. The study site is located near Manu National Park (see e.g. Wilson and Sandoval 1996). Vegetation at the site is secondary forest. The average annual precipitation at the site ranges from 2700 to 3000 mm and the mean annual temperature is around 23 degrees Celsius.

The specimen was collected by Malaise trapping. The model used was that of Marris House Nets (UK). The same kind of traps from the same supplier have been used by InBio in Costa Rica in sampling the Costa Rican insect fauna (Gauld 1991, Hanson and Gauld 1995) and by Sääksjärvi et al. (e.g. 2004, 2006) in sampling the ichneumonid fauna of the Peruvian Amazonia in the Iquitos area.

The female holotype of *Xanthopimpla jussilai* sp. n. was collected by Dr. Terry L. Erwin and his research team from the lowland rain forest canopy at Onkone Gare (0°39'25.7"S, 76°27'10.8"W) at 220 m elevation in the Department of Orellana, Ecuador, on the 25th of June, 1994. The study site is located near the border of the Yasuní National Park. Vegetation at the site is old and diverse primary rain forest. The annual precipitation often exceeds 2500 mm and the temperature never drops below 10 degrees Celsius. The specimen was sampled by canopy fogging. For further information on the study arrangements, see Lucky et al. (2002).

Morphological terminology and form of descriptions used in the study follow those of Gauld (1991). The key is modified from that of Townes (1969). The specimens are deposited in the following collections: The Natural History Museum, London, UK (BMNH) and The Zoological Museum, Section of Biodiversity and Environmental Research, Department of Biology, University of Turku, Finland (ZMUT). The holotype of *X. jussilai*, which is deposited at the National Museum of Natural History (NMNH), Smithsonian Institution, Washington DC, USA, is currently on loan to ZMUT. All observations were made by using Olympus SZX10 and SZ40 and Leica MZ12 stereomicroscopes. Digital photos were taken using an Olympus SZX16 stereomicroscope attached to an Olympus E520 digital camera. Digital photos were combined using the CombineZP programme created by Alan Hadley (http://www.hadleyweb.pwp.blueyonder.co.uk/index.htm).

Key to the Neotropical *Xanthopimpla* (modified from Townes 1969)

1 Propodeum with only posterior transverse carina present; metasoma entirely yellow ..... ***X. peruana*** **Krieger**

– Propodeum with both posterior transverse and anterior transverse carinae present (Figs 2, 6); metasoma usually with brown or black markings **2**

2 Dorsal part of occipital carina lacking; ovipositor sheath usually relatively long, 1.0-1.1 as long as hind tibia* ..... ***X. aurita*** **Krieger**

– Dorsal part of occipital carina present, from weak to very strong (Figs 4, 8); ovipositor sheath less than 0.9 as long as hind tibia **3**

3 Dorsal part of occipital carina very strong, forming vertical flange (Figs 4, 8); mesosternum black (Figs 1, 5) **4**

– Dorsal part of occipital carina weak and low; mesosternum yellow **5**

* Gauld (1991) noted that some *X. aurita* specimens may have a shorter ovipositor (0.8-0.9 as long as hind tibia). According to Gauld the range 0.8-1.1 may not be continuous but bimodal.

4 Central part of posterior transverse carina horizontal (Fig. 6); propodeum with lateral longitudinal carina present, defining area dentipara (Fig. 6); yellowish species with wide black markings on occipital area (Fig. 8); vertical black stripe on posterior part of mesopleuron ..... ***X. jussilai* sp.n.**

– Central part of posterior transverse carina bowed (Fig. 2); lateral longitudinal carina absent, not defining area dentipara (Figs 2, 3); bright yellow species with small black markings on occipital area, vertical black stripes on anterior and posterior part of mesopleuron (Fig. 1) ..... ***X. amazonica* sp.n.**

5 Lateral longitudinal carina of propodeum absent, not defining area dentipara; hind femur with a brown stripe on front side..... ***X. rhabdomera* Townes**

– Lateral longitudinal carina of propodeum present, at least partly defining area dentipara; hind femur lacking a brown stripe on front side **6**

6 Area superomedia separated from area dentipara by complete or subcomplete carina; trochanter and nearly always also coxa of hind leg with black markings ..... ***X. craspedoptera* Krieger**

– Area superomedia not separated from area dentipara; trochanter and coxa of hind leg entirely yellow ..... ***X. spiloptera* Krieger**

Descriptions of the new species

***Xanthopimpla amazonica* sp. n. Gómez, Sääksjärvi & Veijalainen**
urn:lsid:zoobank.org:act:00D140B4-5471-43A4-8179-3DE3F0506ABD

Type material. Holotype female (ZMUT): Peru, Dept. of Madre de Dios, Concesión para la conservación Los Amigos, 12°34'07" S, 70°05'57" W, 240 m elev., Isrrael Gómez leg. Malaise trap, 17-21.VIII.2008.

Female (Fig.1). Head in dorsal view moderately short, with genae evenly narrowed behind eyes; frons weakly biconcave; posterior ocellus separate from eye by 0.8-0.9 times its own diameter; occipital carina complete, ventrally, laterally and dorsally expanded into a very high membranous flange (Fig. 4); clypeus relatively flat, basally not clearly separated from face; clypeal apex truncate; malar space 0.3 times as long as basal mandibular width; face polished and pubescent, about 0.8 times as wide as medially high. Pronotum with apical edge strongly reflexed and raised, overlapping propleuron. Mesoscutum pubescent, with notauli strongly impressed anteriorly, bounded in front by high triangular crests (Figs 8, 9); scutellum convex, laterally with high carinae. Mesopleuron polished, centrally almost bare with ventral part densely pubescent; epicnemial carina reaching well above level of lower corner of pronotum. Metapleuron weakly convex, smooth and almost bare; submetapleural carina sharp but low, extending back to insertion of hind coxa. Propodeum in profile abruptly declivous (Fig. 3); anterior transverse carina present except centrally, where it is curved forward joining lateromedian longitudinal carina (Fig. 2); posterior transverse carina complete and medially clearly bowed downwards; lateromedian longitudinal carina present an-

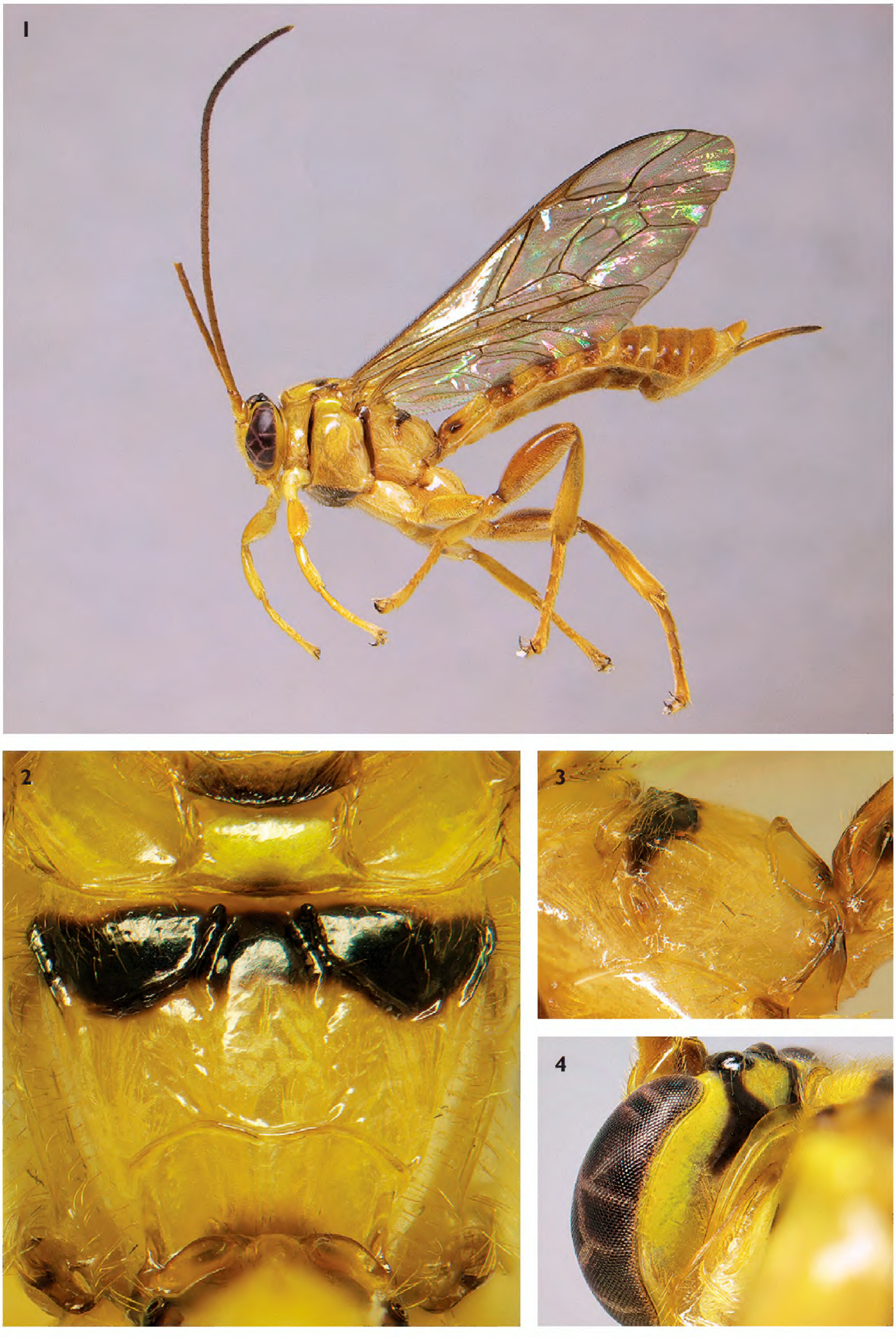

Figure 1-4. *Xanthopimpla amazonica* sp. n. **1** Holotype female, lateral view. **2** propodeum, dorsal view. **3** propodeum, lateral view. **4** head, postero-lateral view.

teriorly but not clearly defining area superomedia; lateral longitudinal carina present anteriorly and posteriorly but not defining area dentipara, lateral carina stronger above spiracle (Fig. 3); area petiolaris divided longitudinally by weak central carina; pleural carina complete. Fore wing length 10-12mm; areolet complete; vein *Rs* sinuous; *cu-a* opposite base of *Rs&M*; discosubmarginal cell evenly, quite closely hirsute. Tergite 1 of metasoma about 1.3 times as long as posteriorly broad, with lateral longitudinal and lateromedian longitudinal carinae developed strongly anteriorly, anterior part of tergite 1 with strong glymma; tergite 2 with a more or less rhombic, raised central area. Hind tibia with five bristles near the apex; fourth tarsomere about 0.9 times as long as broad. Claws of hind leg large, without a basal lobe and with four strong hairs at the base, three of them exceeding the tip of the claw. Ovipositor sheath about 0.8 to 0.9 times as long as hind tibia (Fig.1); apex of ovipositor evenly tapered, slightly decurved with denticles on upper valve.

A bright yellow species with transverse black bands across the mesoscutum centrally, the region of the scuto-scutellar groove, and the anterior part of the propodeum. Interocellar area, small triangular marks on back of head, anterior and posterior margin of mesopleuron and entire mesosternum also black. Tergites orange and with small dark brown punctures posteriorly, anterior part of tergites 1-4 brownish, posterior margins of tergites 1-3 yellowish. Ovipositor sheath generally proximally yellowish, infuscate distally. Antenna with scape yellow ventrally, brownish dorsally, with blackish spot on inner margin. Wings slightly yellowish, pterostigma yellowish.

Male. Unknown.

Diagnosis. This species can be distinguished from all other Neotropical species of the genus by a combination of the following characters: occipital carina forming a vertical flange, propodeum with posterior transverse carina medially clearly bowed downwards, lateral longitudinal carina present only anteriorly and posteriorly, not defining area dentipara, and petiolar area with longitudinal carina.

Biological notes. Nothing is known about the hosts of this species.

Etymology. The name of the species refers to the vast lowland rainforest area of Amazonia, which seems to support most of the Neotropical *Xanthopimpla* species. Many new species of the genus are to be described in the future when Amazonian rainforest habitats become better sampled.

Xanthopimpla jussilai sp.n. Veijalainen, Sääksjärvi & Broad

urn:lsid:zoobank.org:act:CC6CD5B6-682F-4EB8-AB40-3DD6EC7677E4

Type material. Holotype female (NMNH, currently on loan to ZMUT). Ecuador, Dept. of Orellana, Onkone Gare 00°39'25.7"S, 076°27'10.8"W, 220 m elev. Terry L. Erwin leg. Canopy fogging, 25.VI.1994. Paratype female (BMNH) 'Ecuador: Napo, Panacocha. 12.III.1998 M. Cooper. M. Cooper coll. BMNH(E) 2005-152'

Female (Fig. 5). Head in dorsal view moderately short, with genae evenly narrowed behind eyes; frons weakly biconcave; posterior ocellus separate from eye by 0.6-0.7 times

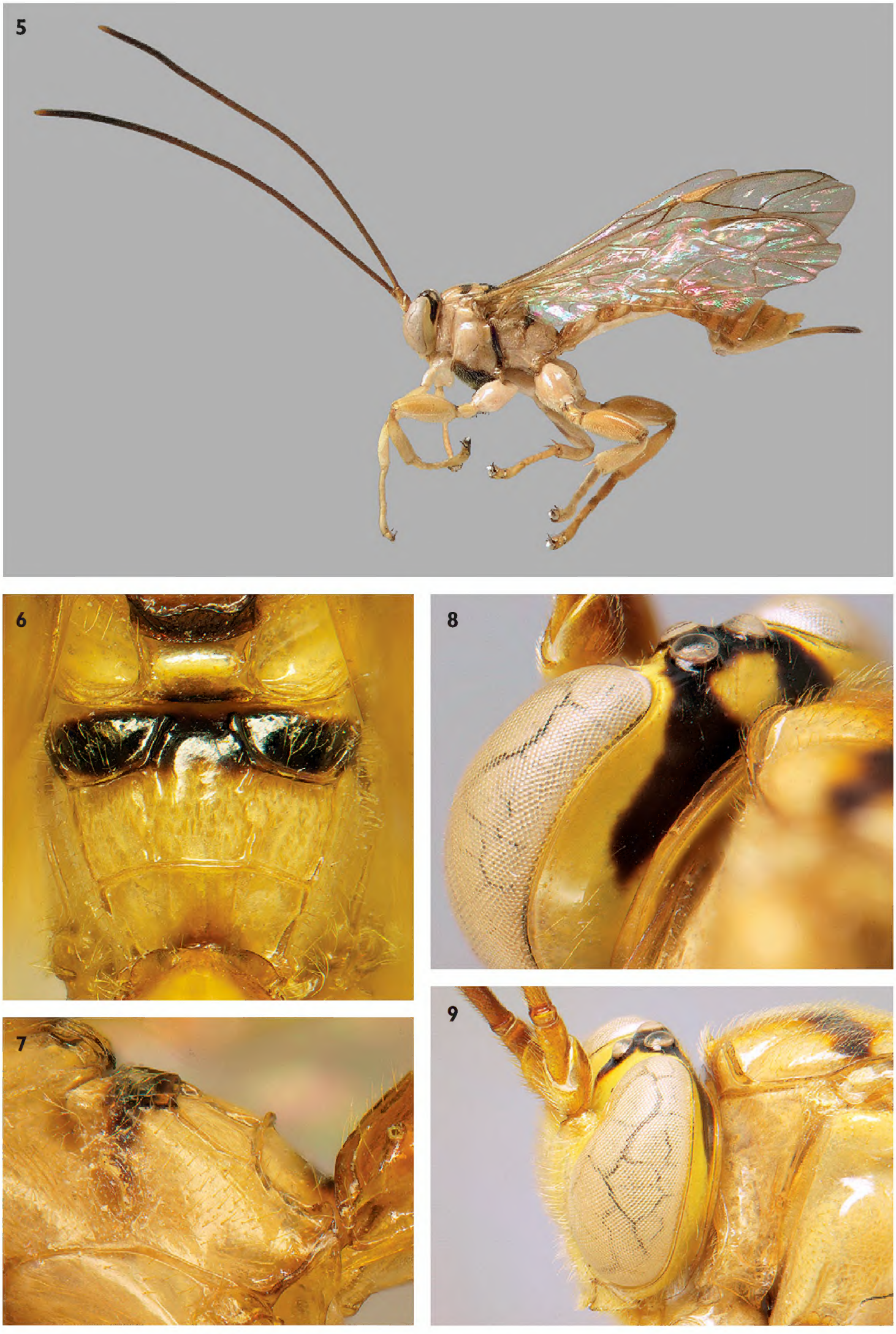

Figure 5-9. *Xanthopimpla jussilai* sp. n. **5** Holotype female, lateral view. **6** propodeum, dorsal view. **7.** propodeum, lateral view. **8** head, postero-lateral view. **9** head and anterior part of mesosoma, lateral view.

its own diameter; occipital carina complete, ventrally, laterally and dorsally expanded into a very high membranous flange (Fig. 8); clypeus relatively flat, basally not clearly separated from face; clypeal apex truncate; malar space 0.4 times as long as basal mandibular width; face polished and pubescent, about 1.0 times as wide as medially high. Pronotum with apical edge strongly reflexed and raised, overlapping propleura (Fig. 9). Mesoscutum pubescent, with notauli strongly impressed anteriorly, bounded in front by high triangular crests (Fig. 9); scutellum convex, laterally with high carinae. Mesopleuron polished, with ventral part densely pubescent; epicnemial carina reaching to well above level of lower corner of pronotum, ventrally strongly raised. Metapleuron weakly convex, smooth; submetapleural carina sharp but low, extending back to insertion of hind coxa. Propodeum in profile abruptly declivous (Fig. 7); anterior transverse carina present except centrally, where it is curved forward joining lateromedian longitudinal carinae; posterior transverse carina complete and medially horizontal; lateromedian longitudinal carina present anteriorly and weakly present centrally, defining area superomedia (Fig. 6); lateral longitudinal carina present, stronger above spiracle; pleural carina complete. Hind tibia with sub-apical patch of three or four strong bristles, one bristle separate at tibia apex. Fourth tarsomere about 0.7 times as long as broad. Fore wing length 10-12mm; areolet complete; vein *Rs* sinuous; *cu-a* opposite or slightly basal to *Rs&M*; discosubmarginal cell evenly, quite closely hirsute. Tergite 1 of metasoma about 1.3 times as long as posteriorly broad, with lateral longitudinal and lateromedian longitudinal carina strongly developed anteriorly, anterior part of tergite 1 with strong glymma; tergite 2 with a more or less rhombic raised central area; tergites 2 and 3 with posterior transverse grooves strongly, longitudinally costate, sculpture weaker on successive tergites. Claws of hind leg large, without a basal lobe and with four strong hairs at the base, one of them exceeding the tip of the claw. Ovipositor sheath 0.8 times as long as hind tibia (Fig. 5); apex of ovipositor evenly tapered, decurved, with denticles on upper valve.

A pale yellow species with transverse black bands across the mesoscutum centrally, the region of the scuto-scutellar groove and the anterior part of the propodeum. Interocellar area, stripes leading from posterior ocelli to large, dorso-lateral patches on occipital area, mesosternum and posterior margin of mesopleuron black. Tergites orange with posterior margin of tergites 1-3 yellowish. Scape yellow in frontal view and brownish dorsally. Antennal flagellum brown, paler ventrally but entirely dark apically, except apical flagellomere distally orange. Ovipositor sheath proximally yellowish, infuscate distally. Wings slightly yellowish, pterostigma yellowish.

Male. Unknown

Diagnosis. This species can be distinguished from all other Neotropical species of the genus by a combination of the following characters: occipital carina forming a vertical flange, posterior transverse carina medially horizontal and lateral carina present, defining area dentipara.

Biological notes. Nothing is known about the hosts of this species.

Etymology. This species is named in honour of Dr. Reijo Jussila, Finnish ichneumonologist, who has dedicated 50 years of his life to studying the taxonomy of the family Ichneumonidae and supervising younger researchers.

Acknowledgements

We are thankful to Dr. Santiago Bordera, Dr. Terry L. Erwin, Dr. Rosmarina Marín, Dr. Nigel Pitman, Dr. Alexander Rodríguez, Dr. Kalle Ruokolainen and Dr. Hanna Tuomisto for their vital support during the execution of this study. Dr. Andrew Bennett and an anonymous reviewer gave very useful suggestions and corrections to the manuscript. This work only became possible through the support offered to the first author by the Amazon conservation Association (Peru) and the CIMO Fellowships for International Young Researcher (Finland), and to the third author by The Finnish Biological Society Vanamo, The Finnish Cultural Foundation and the Valto Takala stipend of Turun Suomalainen Yliopistoseura. The Ministry of Agriculture of Peru provided the collecting and export permits for the Peruvian samples.

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